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E.1 INTRODUCTION

This Customer Payload Requirements (CPR) plan begins the contractual process and defines preliminary agreements between NASA/GSFC and the HH customer concerning the unique information needed for the preparation, flight and disposition of the payload. The general plans for the handling of HH payloads are defined in the HH CARS Document #740-SPEC-008 (formerly #HHG-730-1503-07).

Upon signature of this CPR plan, the payload customer agrees to meet all applicable requirements, (i.e. mechanical, electrical and thermal interfaces and deliverables, safety assessments and deliverables, etc.) as specified in the HH CARS document, for flight as a HH payload. In addition, signature of this CPR plan certifies that this payload contains no items having commercial value to be used for commemorative purposes and financial gain.

The CPR plan is considered a Quality Record as defined by ISO 9000 and, as such, will become a controlled document within the NASA/GSFC HH Configuration Management Office. It is not, however, intended as an iterative definition of customer requirements. Therefore, no effort will be made to update the CPR plan after initial approval.

Instead, customer requirements provided in the CPR plan 2will be used as the preliminary input to all necessary documents required by the NSTS, specifically the Payload Integration Plan (PIP) and associated PIP Annexes. Thereafter, the PIP and PIP Annexes will be iterated to reflect evolving customer requirements. Signature of this CPR plan by the customer provides authority to the HH Mission Manager to represent the payload customer in the review and approval of the PIP and PIP Annexes.

The PIP and PIP Annexes are maintained under configuration control at NASA/JSC as part of the Flight Data File (FDF). Copies of these documents are available to the payload customer upon request.

ATTACHMENT E.1
NASA HITCHHIKER PROGRAM
CUSTOMER PAYLOAD REQUIREMENTS (CPR)

HITCHHIKER PROGRAM

CUSTOMER PAYLOAD:

CUSTOMER:

DATE:

CUSTOMER APPROVAL:

NASA APPROVAL:

Payload Manager	Date	HH Mission Manager	Date
Payload Organization	Date	HH Project Manager	Date

TABLE E.1 CUSTOMER DATA

CUSTOMER PAYLOAD NAME: _____

CUSTOMER PAYLOAD ACRONYM: _____

CUSTOMER NAME, ADDRESS, AND TELEPHONE NUMBER: _____

_____

_____

NAMES AND PHONE NUMBERS OF CUSTOMER CONTACTS:

PROGRAM MANAGER: _____

PAYLOAD MANAGER: _____

SAFETY: _____

ELECTRICAL: _____

SOFTWARE: _____

MECHANICAL: _____

THERMAL: _____

OPERATIONS: _____

SCIENCE: _____

CALENDAR INTERVAL DURING WHICH FLIGHT IS REQUESTED:_____

EARLIEST DATE AT WHICH QUALIFIED PAYLOAD WILL BE AVAILABLE: _____

E2. PAYLOAD DESCRIPTION

E2.1 Mission Objectives

Provide a brief description of the mission objectives of this payload.

E2.2 Physical Description

The payload consists of physically separate assemblies which are listed in Table E.2. For each assembly the weight, size, and field of view (if any) requirements are given, along with allowable ranges for operating and nonoperating (storage) temperatures and average power dissipation. Photographs or detailed drawings of each assembly are enclosed. The mounting requirements are either "Standard canister," "Opening-lid canister," "Plate", or "Direct". Figure E.1 is a sketch showing the assemblies and any cables interconnecting the assemblies, the location of the Carrier standard electrical interconnects, the location of surfaces requiring fields of view, and the location of any items requiring access such as purge ports or "red-tag" covers.

E2.3 Payload Functional Description And Method

Provide a brief functional description of the payload, describing the role each element plays in achieving the mission objectives. This description must cover all modes of operation.

E2.4 Operational Scenario

E2.4.1 Operations Description

Provide a brief description of the operations scenario to achieve the mission objectives. Describe the manner in which the payload will be operated, including any necessary interaction between astronauts or ground operations personnel and the payload.

E2.4.2 Critical Procedures

Identify any operations procedures which are critical to mission success or payload safety.

TABLE E.2 PAYLOAD ASSEMBLIES

PAYLOAD ASSEMBLIES

ASSEMBLY NAME	WEIGHT (lbs)	SIZE X (in)	Y (in)	Z (in)	MOUNT TYPE	FOV (deg)	OPERATING TEMPERATURE MIN	MAX	NON-OPERATING TEMPERATURE MIN	MAX	STORAGE TEMPERATURE MIN	MAX

(CUSTOMER SUPPLIED DRAWING)

FIGURE E.1 PAYLOAD GENERAL ARRANGEMENT

E3. PAYLOAD REQUIREMENTS FOR CARRIER STANDARD SERVICES

E3.1 Carrier To Payload Electrical Interfaces

E3.1.1 Hitchhiker Payloads

The payload will meet the standard electrical interface requirements (including connectors, pin assignments, impedances, signals, levels, etc.), specified in the CARS. This payload will require of the standard signal interface connections or "ports" and _____ of the standard power interface connections or "ports". For each of the ports, a copy of Table E.3.1.1 must be filled in to show which of the standard electrical services will be required by the payload. Unused services will be left open circuited in the payload unless other termination is required by GSFC.

E3.1.2 HH-J Payloads

The payload will meet the standard electrical interface requirements (including connectors, pin assignments, impedances, signals, levels, etc.), specified in the CARS. HH-J payloads are allotted a subset of the standard signal interface functions. This payload will require _____ of the standard signal interface connections or "ports".

(NOTE: HH-J payloads have the option of orbiter power or battery power. Choose which of the following two sentences describes your option.)

This payload will also require _____ of the standard power interface connections or "ports".

or

This payload will supply internal batteries to power the experiment.

For each of the ports, a copy of Table E.3.1.2 must be filled in to show which of the HH-J electrical services will be required by the payload. Unused services will be left open circuited in the payload unless other termination is required by GSFC.

TABLE E-3.1.1 STANDARD AVIONICS PORT REQUIREMENTS (HH CUSTOMERS)

PORT NUMBER:	_____	
SIGNAL INTERFACE CONNECTION		
NUMBER OF BILEVEL COMMANDS (4 MAX) (2.4.2):	_____	
NUMBER OF THERMISTORS (3 MAX) (2.4.7.2):	_____	
ASYNCHRONOUS UPLINK (2.4.4):	_____	CPS
ASYNCHRONOUS DOWNLINK (2.4.5):	_____	CPS
MEDIUM RATE KU-BAND DATA RATE (2.4.6):	_____	KB/S
ANALOG DATA (2.4.7.1):	_____	
IRIG-B GMT (2.4.8):	_____	
GMTMIN (2.4.8):	_____	
CREW PANEL SWITCHES (2.4.10):	_____	
ORBITER CCTV INTERFACE (2.4.12):	_____	
PORT TO PORT INTERCONNECT REQUIRED (2.4.11):	_____	
POWER INTERFACE CONNECTION		
POWER CIRCUIT A – 10 AMPS MAX:	_____	AMPS
POWER CIRCUIT B – 10 AMPS MAX:	_____	AMPS
POWER CIRCUIT HTR - 2.5 AMPS MAX:	_____	AMPS
TOTAL ENERGY REQUIRED A&B:.	_____	KWH
OTHER (DEFINE):	_____	

TABLE E-3.1.2 HH-J AVIONICS PORT REQUIREMENTS

PORT NUMBER: _____

SIGNAL INTERFACE CONNECTION

NUMBER OF BILEVEL COMMANDS (4 MAX) (2.5.2.5): _____

NUMBER OF THERMISTORS OR MALFUNCTION INPUTS (3 MAX)
(2.5.2.3 & 2.5.2.10): _____

ANALOG DATA (2.5.2.4): _____

RELAY K1 (2.5.2.2): _____

RELAY K2 (2.5.2.2): _____

CAN TO CAN INTERCONNECT REQUIRED (2.5.2.6): _____

POWER INTERFACE CONNECTION

POWER CIRCUIT A - AMPS MAX (10 AMPS MAX): _____ AMPS

POWER CIRCUIT B - AMPS MAX (10 AMPS MAX): _____ AMPS

POWER CIRCUIT HTR - AMPS MAX (10 AMPS MAX): _____ AMPS

TOTAL ENERGY REQUIRED A&B (4 Kwh MISSION MAX): _____ KWH

OTHER (DEFINE): _____

E3.2 Carrier To Payload Mechanical Interfaces

The payload will meet the standard mechanical interface requirements specified in the CARS. Mechanical drawings and other documentation will be supplied in sufficient detail for GSFC to perform user accommodation studies and ultimately draft the MICD. Section 2 of CARS addresses most of the information required for accommodation studies. The MICD Requirement Information List in Section 3.1.1.3.2 of the CARS lists the data required for inclusion on the MICD.

E3.3 Carrier To Payload Thermal Interfaces

The customer will meet the standard thermal interface requirements specified in Section 2.2 of the CARS. A description of the thermal design concept for the payload follows:

E3.4 Ground Operations Requirements

Table E.4 defines the handling and ground services required by the payload. Ranges are expected to be typical clean room environments unless otherwise specified by the customer.

TABLE E.4 GROUND OPERATIONS REQUIREMENTS

(Ranges are expected to be cleanroom environments unless specified uniquely.)

a. MAXIMUM AND MINIMUM ALLOWED STORAGE TEMPERATURES: .....

b. MAXIMUM AND MINIMUM ALLOWED RELATIVE HUMIDITY: .....

c. CLEANLINESS REQUIREMENT FOR PAYLOAD INTEGRATION & TESTING: .....

d. CUSTOMER SUPPLIED GROUND SUPPORT EQUIPMENT REQUIRED TO SERVICE PAYLOAD. (EXCLUDING CGSE IN SECTION 3.4): .....

e. REQUIREMENTS FOR GASES OR LIQUIDS: .....

f. REQUIREMENTS FOR PAYLOAD SERVICING AT GSFC: .....

AT KSC: .....

g. REQUIREMENTS FOR ACCESS DURING ORBITER INTEGRATION: .....

h. REQUIREMENTS FOR ACCESS ON LAUNCH PAD: .....

i. REQUIREMENTS FOR POST-LANDING ACCESS: .....

j. ANY OTHER SPECIAL REQUIREMENTS FOR HANDLING AT INTEGRATION AND TEST OR LAUNCH SITE: .....

k. SIZES AND WEIGHTS OF ITEMS REQUIRED FOR SHIPMENT TO INTEGRATION OR LAUNCH SITES (EXCLUDING CGSE OF Table E.14): .....

ITEM	SIZE	WEIGHT

E3.5 Safety

Table E.5 requires a "no" or "yes" answer to items related to payload safety. Details of items identified "yes" are also given.

TABLE E.5 PAYLOAD SAFETY RELATED ITEMS

a. CONTAINS PRESSURIZED VOLUME(S): _____
b. CONTAINS RADIOACTIVE MATERIAL: _____
c. CONTAINS LIGHT OR RF SOURCE: _____
d. EXTERNAL ELECTRIC OR MAGNETIC FIELDS: _____
e. EXTERNAL ELECTRICALLY CHARGED SURFACE: _____
f. EXTERNAL HOT OR SHARP SURFACE: _____
g. CONTAINS TOXIC MATERIAL (E.G., HG, BE): _____
h. CONTAINS OUTGASSING MATERIAL: _____
i. VENTS FLUIDS OR GASES: _____
j. CONTAINS CRYOGENS: _____
k. HAS MOVING EXTERNAL PARTS: _____
l. CONTAINS EXPLOSIVE DEVICES: _____
m. CONTAINS OR GENERATES EXPLOSIVE OR FLAMMABLE MATERIAL OR GAS: _____
n. CUSTOMER SUPPLIED GSE CONTAINS RADIOACTIVE MATERIAL, LIGHT OR RF SOURCES, PRESSURIZED VOLUME: _____
o. BATTERIES: _____
p. ANY OTHER HAZARD: _____

DESCRIPTION OF IDENTIFIED HAZARD(S):

E3.5.1 Safety Matrix

The Payload Safety Matrix and Descriptive Data Form contained in Appendix A, figures A.4, A.5, A.6 and A.7 should be used to provide an estimate of payload safety hazards. The intent of the forms is to assist in tabulating identified hazards associated with payloads and GSE. Directions for preparing these forms are given in Appendix A, page A-10 for the Payload Safety Matrix and A-13 for the Descriptive Data Form.

E4. MISSION OPERATIONS REQUIREMENTS

On-orbit operations are provided by the Mission Operations Manager using the facilities of the GSFC Mission Operations and Data Systems Directorate. The following information is necessary to determine the support required for the payload. (All paragraphs apply to both HH and HH-J payloads.)

E4.1 Operational Scenario

Provide a more detailed description of your experiment operations. Include overall mission operations as well as individual cycles such as activation, outgassing, cooldown, warmup, door open, checkout, calibration, data take and deactivation. Define the duration of each phase. Include information on orbiter inclination, orbiter altitude, orbiter attitude and whether operations must occur during orbit day or night. Clearly identify which of these items are required vs desired.

E4.2 Experiment Power

In Table E.6, provide power profiles for your equipment. Each phase of your experiment operations should be included. The "idle" power involves the powering of base equipment; base equipment is activated once, at the beginning of the payload activation and draws power continuously until the final payload deactivation. The "nominal" power is considered the typical power dissipation during the actual experiment data take phases of the operations; the "peak" power is the maximum (short term) power dissipation during the experiment data take phases of operations.

TABLE E.6 EQUIPMENT POWER PROFILE

PHASE/EQUIPMENT	Power (watts)			COMMENT/DURATION Attitude
	Idle	Nominal	Peak	

E4.3 Thermal Operations

Describe the thermal operations of your experiment, i.e. do you have heaters? Are they commandable or thermostatically controlled? Describe your thermal constraints in Table E.7 below:

TABLE E.7 THERMAL CONSTRAINTS

Thermostatic Equipment	Duty Cycle (Percent)	Power (watts)	Comment/Duration/Attitude
			Bay-to-Sun (Hot)
			Bay-to-Earth (Nominal)
			Bay-to-Space (Cold)

PAYLOAD with heaters OFF:

Attitude	Maximum Duration	Recovery Time	Effect if Violated
Bay-to-Sun			
Bay-to-Earth			
Bay-to-Space			

PAYLOAD with heaters ON:

Attitude	Maximum Duration	Recovery Time	Effect if Violated
Bay-to-Sun			
Bay-to-Earth			
Bay-to-Space			

E4.4 Experiment Commanding

E4.4.1 Hitchhiker Customers

Describe your command methodology such as time tagged, sequenced and/or realtime commands. Include a commanding timeline for each cycle. Command times should be broken down into the smallest reasonable periods to provide maximum flexibility with the orbiter and other payloads. Identify any hazardous or time-critical commands.

E4.4.2 HH-J Customers

Activation and deactivation of the payload will be via PGSC by a crew member. The crew will activate the payload by setting relays K3 and K4. If required, define which of the following commands need to be sent, at what intervals, and in what sequence.

TABLE E.8 PAYLOAD CONTROL FUNCTIONS

RELAY	State	Payload Functions	Intervals
K1	Hot (H) Latent (L)		
K2	Hot (H) Latent (L)		
Bilevel 1	High LOW		
Bilevel 2	High LOW		
Bilevel 3	High LOW		
Bilevel 4	High LOW		

E4.4.3 Critical Commands

Identify any critical commands which, if incorrectly transmitted, could damage the payload.

E4.5 Experiment Telemetry

E4.5.1 Hitchhiker Customers

Your experiment telemetry (low rate, medium rate and/or video) is described in Tables E.9 and E.10. Is the data continuous or packet-type output? Produce a telemetry timeline for each cycle. How much telemetry is required/desired for each cycle? How many hours total do you expect to downlink data during the mission? Describe any data recording capabilities as well as any need for dumping such data. Will the data be dumped forward or backward? Are there any expected anomalies in the down link data (i.e., timing jumps, burst data, fill data)?

TABLE E.9 LOW RATE DATA STREAM CONTENTS

(NOT REQUIRED FOR HH-J)

COMMANDS/TELEMETRY	BAUD	RS232	RS422
Commanding to ACCESS	**1200**		
Async Data Unformatted	**1200**		
Async Data Formatted	**19.2k**		
Analog Data	**19.2k**		
ACCESS Ancillary Data	**19.2k**		
Shuttle Orbit/Attitude Data	**19.2k**		
PCM-A	**19.2k**		
PCM-B	**19.2k**		
Command Status	**19.2k**		
Data Link Status	**19.2k**		
ACCESS AIA Data	**19.2k**		

Refer to CARS section 2.4.11.2 for a description of the data formats.

TABLE E.10 MEDIUM RATE DATA CHARACTERISTICS

Experiment Name	Rate (Kbps)	Frame Sync Pattern (Hex)	Frame Counter Location	Minor Frame (mf) Size (bytes)	Major Frame Size (mf)	FILL PATTERN
Ex:						
DXS	100	0005BB2	BYTE 2	1024	256	FFF

E4.5.2 HH-J Customers

Using Table E.11, define the sampling interval of any payload telemetry and whether the crew needs the data displayed. Are the commands that need to be sent as determined by telemetry readings?

TABLE E.11 PGSC PAYLOAD STATUS DATA

TELEMETRY	SAMPLING INTERVAL	DISPLAYED
Thermistor 1		
Thermistor 2		
Thermistor 3		
Analog		
K3 Current Draw		
K4 Current Draw		

E4.6 Crew Involvement

Describe any special crew operations such as photographic coverage or Payload General Support Computer (PGSC) interaction with the payload. Switch panel and attitude maneuver control need not be specified.

E4.7 Orbiter Pointing

Describe any orbiter orientations required/desired for each cycle of your experiment operations, such as attitude hold, rotation, target track, gravity gradient, free drift, etc. Deadbands should be specified as well as durations for each orientation. Identify your restrictions to orbiter pointing in Table E.12.

TABLE E.12 ORBITER POINTING RESTRICTIONS

Restriction	Duration	Angle	Effect If Violated
RAM			
Sun			
Moon			
Earth			
Earthlimb			
Umbra			

E4.8 Instrument Field Of View

Describe your instrument Field of View (FOV). Include the instrument axis orientation and origin relative to the orbiter, instrument motion, field of view location and size.

E4.9 Contamination Constraints

Identify your contamination constraint tolerance in Table E.13.

TABLE E.13 CONTAMINATION CONSTRAINTS

Contaminant	Duration of Exposure	Time Until Operations Resume	Effect if Violated
Payload bay lights on			
Flash Evaporator System			
(FES) operations			
Fuel Cell Purge (FCP) Operations			
Vernier Reaction Control System (VRCS) burns			
Primary Reaction Control System (PRCS) burns			
Orbital Maneuvering System (OMS) burns			
Electron Contamination Regions (ECR)			
Water Dumps			
South Atlantic Anomaly (SAA)			

E4.10 Customer Supplied Ground Support Equipment (CGSE)

E4.10.1 Hitchhiker Customers

The payload will require two customer-supplied and operated CGSEs. One (the operations system) will provide control and display during integration and test activities of the payload to carrier, system tests, end-to-end tests, Joint Integration Simulations, and flight operations at GSFC. The other (the test system) will support the functional tests, CITE tests, and Orbiter IVT

test at KSC. Table E.14 provides information about the CGSEs. Diagram E.1 indicates the configuration of the CGSE and the ACCESS both for testing and for operations.

E4.10.2 HH-J Customers

The payload does not require a customer-supplied and operated CGSE. Analog and/or temperature data collected during the mission will be available post-flight.

TABLE E.14 CUSTOMER GROUND SUPPORT EQUIPMENT (CGSE)
(NOT REQUIRED FOR HH-J)
TEST SYSTEM

TYPE/MAKE OF UNIT	WEIGHT	POWER (Voltage/Current)

Will the CGSE transmit commands?_____
Will the CGSE receive low rate data?_____
Will the CGSE receive medium rate data?_____
Number of standard 115 VAC outlets required:_____
Floor space required:_____Sq.Ft.

OPERATIONAL SYSTEM

If there will be a backup system, describe that separately (i.e., equipment available but not set up, not backup, etc.)

TYPE/MAKE OF UNIT	PURPOSE	WEIGHT	POWER (Voltage/Current)

Number of standard 115 VAC outlets required: _____
Floor space required: _____Sq.Ft.
Air conditioning required? _____
Will the CGSE transmit commands? _____
Will the CGSE receive low rate data? _____
Will the CGSE receive playback data? _____
During/Post mission? _____
Will the CGSE receive medium rate data? _____
Will the CGSE receive orbit/attitude data? _____

DIAGRAM E.1

CGSE/ACCESS CONFIGURATION

(NOT REQUIRED FOR HH-J)

TEST:

OPERATIONS:

E4.11 Payload Operations Control Center (POCC) Requirements

E4.11.1 Hitchhiker Customers

Approximately how many people/positions do you intend to have in the POCC during the mission? Identify the positions.

How many customer space units will you require? One customer space unit includes:

1 3' x 5' table
2 standard outlets
1 video outlet port
1 data phone
1 call director (2 people can talk/listen)
1 color display unit

Identify any additional requirements not listed above.

Will you need additional space for non-operations personnel that will be monitoring the mission?

E4.11.2 HH-J Customers

POCC commanding and telemetry downlink of HH-J payloads is not available.

E4.12 Post-Mission Data Products

E4.12.1 Hitchhiker Customers

Do you desire Calibrated Ancillary System (CAS) parameter data?_____

Do you desire to receive post-mission products of your telemetry data? _____

If yes, complete the following:

PRODUCT	MEDIUM	TEST CD
Low Rate Tim	CD	
Medium Rate Tim	CD	

Data will be provided on Compact Disks (CDs).

What name and address should these products be sent to?

E4.12.2 HH-J Customers

Telemetry and commanding sequence log files captured during the mission will be available on 3.5" floppy disk.

E5. PAYLOAD REQUIREMENTS FOR OPTIONAL SERVICES

This section will contain descriptions and estimated costs for any optional services to be provided.

E6. TBDS AND DUE DATES

Identify any TBDs and associated due dates in Table E.15.

TABLE E.15 TO BE DETERMINED ITEMS

SECTION	DESCRIPTION	DUE DATE

Note: Upon signature of this CPR the customer assumes agrees to meet all the applicable customer requirements, i.e safety, mechanical and thermal model delivery, etc. as specified in the CARS document, for flight as a Hitchhiker payload.